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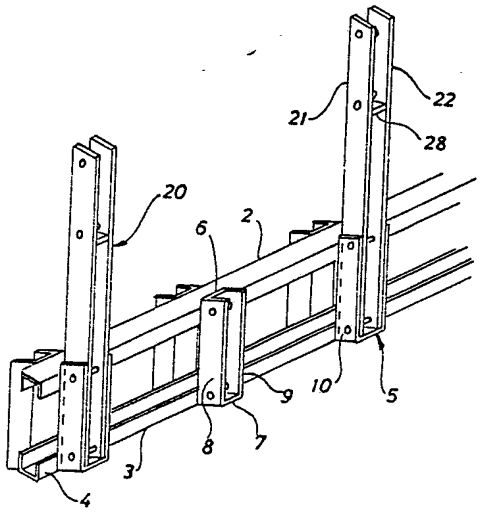
(54) Title: BUILDING ELEMENT

(57) Abstract

A building element consisting of two continuous outer elements (2, 3) extending at a certain distance from one another and along the longitudinal edges of the element and a number of supporting elements (5) affixed at a certain distance from one another. The supporting elements connect the outer elements securely to one another and extend between the outer elements in the transverse direction of the latter. The supporting elements (5) are affixed to the outside of the outer elements (2, 3) on at least one of their surfaces (4). They are executed with a bottom part (6), which is so arranged as to be attached to the two outer elements between which the supporting element extends, and with flanges (8) extending out from the bottom part, which flanges extend essentially in said transverse direction in relation to the outer elements and at least one supporting part (7) arranged transversely to the flanges. The supporting element (5) is thus capable, in addition to holding together the outer elements, of constituting shoes so aranged as to engage around and support the end of a second building element on a building frame, such as an upright (20), or in particular a secondary beam aranged transversely to the building element, whilst the building element constitutes the primary beam in the building frame.



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Title:

Building element

Technical Field:

The present invention relates to a building element consisting of at least two continuous outer elements extending at a certain distance from one another and along the longitudinal edges of the element and a number of supporting elements affixed at a certain distance from one another, so arranged as to connect the outer elements securely to one another and extending between the outer elements in the transverse direction of the latter.

Background:

Those beams which between them support other beams in a building are known as primary beams, and the beams supported by these beams, which preferably support a framing of joists, are known as secondary beams. Various solutions have been disclosed for the purpose of connecting together the directly load-supporting secondary beams to the primary beams. One method is to lay the secondary beams on the primary beams, in this way achieving a continuous secondary beam system. The disadvantage of this design is that those primary beams which are not flush with the wall or which do not lie in the line of the facade are visible inside the room. Another method is to provide the primary beams with beam shoes in which the secondary beams rest. The advantage of this is that no visible primary beams will result if the same structural height is specified for both types of beam. These beam shoes are only attached to the primary beams on the building site and represent a time-consuming operation because of the high accuracy required in the attachment of the beam shoes to the primary beam, for which special skill is demanded of the staff. The above observations in respect of the advantages and disadvantages of the secondary beam system with regard to

individual beams which are assembled on site can be transferred directly to pre-fabricated joist framing systems made of various materials, such as wood, steel and concrete.

In the construction of buildings the joist framing is utilized in particular for the water supply system, the sewerage system and the air conditioning system, which now occupy an increasingly large space inside a building. The systems are concealed in this way, at the same time as they are easily accessible for inspection, repair and, if necessary, replacement. Lattice girders with diagonal bracing for the ribs of the girder are frequently used as supports for the joist framing. However, the use of these lattice girders poses problems in connection with the routing of installations such as drums and pipes because the diagonal bracing reduces the opening through which the installations are passed. Free space for these units can be created by the provision of special interchanges, although one will then be restricted to the position of the interchanges on the beam, and the design will have to be dealt with individually in each case. A previously disclosed type of beam, known as the quadrilateral beam, is characterized in that the beam lacks diagonals. The components which make up the beam consist of horizontal flanges made of steel and vertical bracing made of the same material which lie within the outer ribs of the flanges. Beams of this kind have been found to offer advantages and have gained widespread applications.

The difference between using pre-fabricated primary and secondary beams which are then clad with pre-fabricated panels and using joist framing elements lies in the fact that, in the latter case, all the primary systems in the joist framings are installed at the factory. This has been found to present major technical difficulties and also to result in poor overall economy, due to the fact that the variable requirements in respect of the installation mean that the benefits of large-scale production cannot be achieved. Problems are also encountered in conjunction with connecting up the parts of the installation on site. The transport bulk is also considerable, and in the case of exports to other countries those components which are familiar and approved

in the exporting country may be entirely unknown and may be difficult to have approved and repaired, should this prove necessary. Another important factor is the requirement for most of the installation units to be capable of being inspected on site. This requirement is contained in the building regulations of a large number of countries.

Technical Problem:

In order to be able to meet various requirements of both a technical and an economic nature, it has been observed that the execution of the joist framing elements for the floor and the outer roof, for example, is of considerable importance. The disadvantages of the existing designs in accordance with the primary beam system with concealed beams is that the suspension arrangement for the secondary beams is in the form of separate units which are affixed to the primary beams in the manner outlined above. They are so dimensioned as to withstand the load of the secondary beam, mainly the bearing pressure. In a more straightforward design a longitudinal wooden or steel profile is attached to the lower flange of the primary beam and in this way absorbs the bearing pressure. In both cases a unit is attached which has the single function of dealing with the load from the individual secondary beam. The units in this case do not interact statically with the primary beam.

The Solution:

The aforementioned disadvantages are eliminated through the invention by means of a building element of the kind indicated to which the supporting elements are affixed outside the outer elements on at least one of their surfaces, and the supporting elements are executed with a bottom part, which is so arranged as to be attached to the two outer elements between which the supporting element extends, and with flanges extending out from the bottom parts, which flanges extend essentially in said transverse direction in relation to the outer elements and at least one supporting part arranged transversely to the flanges.

The supporting element holds together the outer elements and constitutes shoes so arranged as to engage around and to support the end of a second building element in a building frame, in particular a secondary beam set at right angles to the building element, whilst the building element constitutes the primary beam in the building frame.

Advantages:

Achieved through the present invention is a light and strong building element in the form of a beam, intended in particular as a primary beam, which exhibits essentially vertical lattice components and in which the connections between the primary and secondary beams constitute statically interacting units.

Brief Description of Drawings:

The invention is described in greater detail below in relation to an illustrative embodiment with reference to the accompanying drawings, in which Fig. 1 shows a side view of a building element, Fig. 2 shows a horizontal section along the line II-II in Fig. 1 of the aforementioned building element, Fig. 3 shows a section along the line III-III in Fig. 2 of an arrangement of the building element, Fig. 4 shows a second embodiment of the building element, Fig. 5 shows a third embodiment of the building element, Fig. 6 shows a fourth embodiment of the building element, Fig. 7 shows a fifth embodiment of the building element, Fig. 8 shows a partially exposed view of a system of roof tie beams exhibiting three of the embodiments of the building elements, Fig. 9 shows a partially exposed view of a second type of roof tie beam system containing elevated ribbon windows, Fig. 10 shows an exposed perspective view of a building element incorporated in the roof tie beam system shown in Fig. 9, Fig. 11 shows a perspective view of the building frame for a pre-fabricated building during erection, Fig. 12 shows a corresponding perspective view in which the building frame is supplemented with secondary beams and elevated ribbon windows, Fig. 13 shows a perspective view of a second type of building frame for a pre-fabricated building during erection and

fitted with supplementary installations, and Fig. 14 shows an exposed side view of a building element with an arrangement for regulating the pitch of the roof.

Best Mode of carrying out the Invention:

The invention is described below in connection with a building with a sloping roof, but can, of course, also be applied to other types of buildings and can also have other areas of application, such as in a bridge, for example. As will be appreciated from Fig. 1 and Fig. 2, a building element 1 in the form of a beam exhibits two parallel, continuous and opposing rails 2, 3, for instance in the form of U-profiles, with their open parts appropriately facing towards one another and exhibiting outer ribs 4. The rails are situated at a certain distance from one another and are attached to upright supporting elements installed essentially at right angles to the longitudinal direction of the rails and attached outside the outer ribs of the rails, which supporting elements are referred to in the following as the beam shoes 5. As illustrated in fig. 2, the beam shoes are securely attached, for example by welding, to either side of the rails on the outside of their outer ribs 4 and directly in line with one another. The latter feature is not essential to the function, and the positions of the beam shoes on one side of the rail may be displaced relative to the positions of the beam shoes on the other side.

As shown in Figs. 1-7, and especially in Fig. 10, the beam shoes incorporate a wall 6, which is in contact at at least two points with the ribs 4 of the rails 2, 3, from which wall a lower supporting surface 7 and two lateral surfaces 8, 9 extend, which together form a sleeve which is open towards the top and along one side which faces away from the building element. The aforementioned lateral surfaces are provided with an appropriate number of holes 10.

As shown in Figs. 3-7, the beam shoes of the building element can exhibit different forms, depending on the point at which the building element is designed to be installed in the building. Shown in Fig. 3 is a section through the building element 1 with

the beam shoes 5 to either side of the rails 2, 3, which beam shoes extend perpendicularly outwards from the rails. A second variant of the beam shoes on the building element is shown in Fig. 4 as a section through a second building element 15, in which case the beam shoe affixed to one side of the rails extends outwards and downwards, and the beam shoe affixed to the other side of the rails extends outwards and upwards. A third variant of the beam shoes is shown in Fig. 5 on a third building element 16, in which case the beam shoes affixed to either side of the rails extend outwards and downwards. Additionally shown in Fig. 6 is a fourth variant of the beam shoes as a section through a fourth building element 17, in which case the rails only exhibit beam shoes on their one sides, and exhibit on their other sides diagonal stays 24 affixed on the outside or on the inside of the outer ribs 4 of the rails 2, 3. Alternatively, the diagonal stays may consist of pre-tensioned cables. A further variant of the beam shoes is shown in Fig. 7 as a section through a fifth building element 18 of identical construction to the fourth building element 17, but in which the beam shoes extend outwards and upwards.

As shown in Figs. 1 and 2, the ends of the building elements are provided with end pieces 11, which are appropriately securely affixed between the rails 2, 3 and between and inside the outer ribs 4. The end pieces are also preferably provided with clearance holes 26.

As shown in Fig. 11, the primary frame of the building contains a number of the building elements 1, 15-18 affixed to uprights 13 standing on base plates 12 preferably by means of removable fixing elements such as screws introduced through the holes 26 in the end pieces 11 and secured to the uprights. Between the aforementioned building elements secondary beams 14, which are utilized as floor joists, are removably affixed to the beam shoes and, resting on the supporting surface 7, are secured by means of fixing elements, not illustrated in the drawings, such as screws introduced through the hole 10 on the side walls 8, 9 of the beam shoes 5. The primary frame also contains peripheral beams 27 which extend between the uprights 13 and are attached directly to same, preferably on a uniform height with the floor joists 14.

Also illustrated in Figs. 12 and 13 is the primary frame provided with the secondary beams which are utilized as roof beams 19 supported by means of the beam shoes 5, but as shown in Figs, 9, 10 and 12, the roof beams can also be supported by uprights 20, each in the form of a forked yoke, which consist essentially of two continuous plates 21, 22 and a supporting plate 28 joining the plates together, in which case the plates 21, 22 are affixed to either side of the side walls 8, 9 of the beam shoes, which side walls extend outwards from the building element in the longitudinal direction of the beam shoes and thus constitute a prolongation of the beam shoes. It is possible to make the uprights telescopic so that their length can be regulated in order to permit a further increase in their area of application. A second variant of the use of the uprights is shown in Fig. 14. The uprights in this case are given different lengths and support the roof beams 19, which in turn support a roof covering designated by 23. The desired pitch of the roof is achieved in this way by very simple means.

As shown in Fig. 13, piping 25 is routed through and is supported by the building elements according to a specific pattern and according to specific wishes.

The building elements 1, 15-18 are particularly advantageous in pre-fabricated constructions which must be capable of being erected quickly, and also in those constructions which must be capable of being dismantled and re-erected in the same or in an entirely new combination. The building elements are thus constructed from components which have been standardized to the greatest possible extent and have been dimensioned in accordance with given load assumptions, in which case the building elements are preferably pre-fabricated in the factory.

When erecting a building utilizing the aforementioned types of building elements, the uprights 13 are first raised and are attached to the base plates 12 in an upright position, with pre-determined distances between them, and with the outer upright forming the outer boundary line of the building. The building elements are then installed between the uprights and are attached

to same by introducing the removable screws through the holes 26 in the end pieces and securing them to the uprights. The type of building elements 17 and 18 shown in Figs. 6 and 7 is installed for this purpose between the uprights, which form the outer boundary line of the building on at least two sides of the building, as shown in Figs. 11-13. The building elements 18 are installed for this purpose preferably to the upper ends of the uprights. These types of the building element are utilized mainly as so-called load-bearing peripheral beams at the outer walls of the building. The primary frame is supplemented on the remaining sides by the non load-bearing peripheral beams 27, which are attached directly to the uprights 13 so that the peripheral beams connect together those sides of the primary frame to which the building elements 17 and 18 are attached, in which case the frame is stayed. The peripheral beams also serve the purpose of bearing the dead weight of the outer wall. The external cladding of the building is subsequently attached to this frame.

As the aforementioned peripheral beams 17, 18 are provided with both beam shoes and diagonal stays 24, these are intended to withstand lateral forces in the beam and to counteract the displacement of the two horizontal rails 2, 3 in relation to one another.

Load-bearing beams shall be understood to denote those beams which support the load of the joist framing and, where an outer wall is present, the weight of the latter. Non load-bearing beams shall be understood to denote those beams which only support the dead weight of the curtain walls and any laterally-acting soil pressure.

The type of building element 1 shown in fig. 3 is then installed inside the building between the uprights and parallel with and at a distance from the peripherally installed building elements 17 and/or 18. This type of building element is used in particular as so-called load-bearing central girders, which replace a middle partition of baywork in a building of conventional construction and are used to support the floor joists 14 on which a floor panel, for example, can be laid, as shown in

Figs. 12 and 13, but can also be used to support the roof beams 19. The third type of the building element, which is described in Fig. 4 and Fig. 5, is attached preferably to the upper ends of the uprights 13 in order to support the roof beams 19 in the beam shoes 5. The uprights 20 can be affixed to all the building elements 15-18, which uprights in this case project upwards from the building elements. The uprights can be utilized to support the roof beams 19 so as to form, for example, a saddle on the roof ridge, or so as to form an elevated ribbon window, as shown in Fig. 12.

The building frame formed in the aforementioned manner is now provided with the floor joists 14, the lengths of which are adapted to suit the distance between the building elements. The beams are installed in the beam shoes preferably from above and are lowered between the supporting surfaces 8, 9 in order to seat against the lower supporting surface 7 in the respective beam shoes. The width of the beam shoe, that is to say the distance between the supporting surfaces, is adapted for this purpose to suit the thickness of the beam. The position of the beam is determined by means of fixing elements, such as screws, which are introduced through the holes 10 and into the beam 14. The roof beams 19 are introduced into the beam shoes in the same way and are secured to these by means of fixing elements. The floor joists and the roof beams can be executed in this case as lightweight beams of a previously disclosed kind or as solid wooden beams, although concrete beams and steel beams can also be used. The beams are appropriately executed in the manner indicated in Fig. 13 as lattice girders, which permits the pipework 25 to be routed in any preferred direction and without the need for special measures.

Once the frame has been erected in this way and on the whole exhibits the appearance illustrated in Fig. 13, the frame can be provided with external walls, floors, internal walls and a roof of conventional type.

The advantages of this building element compared with the previously disclosed quadrilateral beam are that the verticals,

that is to say the beam shoes, have been given an additional function by supporting the beams 14 and 19. The building elements in this case have a double function in that not only do they support the forces which act upon the beams 14 and 19, but they also constitute a complete system of support and attachment for the beams.

The invention is not restricted to the illustrative embodiment described above and illustrated in the drawings, but may be varied within the scope of the following Patent Claims.

Patent Claims:

1. A building element (1, 15-18) consisting of at least two continuous outer elements (2, 3) extending at a certain distance from one another and along the longitudinal edges of the element and a number of supporting elements (5) affixed at a certain distance from one another, so arranged as to connect the outer elements securely to one another and extending between the outer elements in the transverse direction of the latter, characterized in that the aforementioned supporting elements (5) are affixed to the outside of the outer elements (2, 3) on at least one of their surfaces (4), and in that the supporting elements are executed with a bottom part (6), which is so arranged as to be attached to the two outer elements between which the supporting element extends, and with flanges (8) extending out from the bottom part, which flanges extend essentially in said transverse direction in relation to the outer elements and at least one supporting part (7) arranged transversely to the flanges, so that the supporting element (5), in addition to holding together the outer elements, constitutes shoes so arranged as to engage around and support the end of a second building element (4, 19) in a building frame, in particular a secondary beam arranged transversely to the building element, whilst the building element constitutes the primary beam in the building frame.

2. A building element according to Patent Claim 1, characterized in that the supporting elements (5) have the form of open sleeves facing in a direction outwards from the building element where two of the flanges (4) facing one another and said transverse supporting elements (2, 3) at the ends of the flanges constitute a position for the second building element (14).

3. A building element according to Patent Claim 1, characterized in that the supporting element (5) is executed as a channel open in a direction outwards from the outer elements (2, 3) and at the edge of one of the outer elements, which channel is closed at the edge of the second outer element by

means of said supporting element (3) so that the supporting element can be utilized in this way to support an upright (20) extending upwards and outwards in the assembly position through the preferably upwardly open end of the supporting element.

4. A building element according to any of the preceding Patent Claims, c h a r a c t e r i z e d in that the bottom part (6) comprises one outward-facing part (8) extending along the outer edge of the supporting element (5) or preferably two outward-facing parts (8) extending along the outer edges of the supporting element, which outward-facing parts are so arranged as to be affixed by their ends to the respective outer elements (2, 3) and to extend between the latter and to support the flanges (4) of the supporting element.

5. The application in a building frame of the building element in accordance with Patent Claims 1-4, consisting of at least two continuous outer elements (2, 3) extending at a certain distance from one another and along the longitudinal edges of the element and a number of supporting elements (5) affixed at a certain distance from one another, so arranged as to connect the outer elements securely to one another and extending between the outer elements in the transverse direction of the latter, for which purpose the aforementioned supporting elements (5) are affixed to the outside of the outer elements (2, 3) on at least one of their surfaces (4), and the supporting elements are executed with a bottom part (6), which is so arranged as to be attached to the two outer elements, and with flanges (4) extending out from the bottom part, which flanges extend essentially in said transverse direction in relation to the outer elements and at least one supporting part (2, 3) arranged transversely to the flanges, so that the supporting element (5), in addition to holding together the outer elements, constitutes shoes so arranged as to engage around and support the end of a second building element (14) in a building frame, in particular a secondary beam set at an angle to the building element, whilst the building element constitutes the primary beam in the building frame, c h a r a c t e r i z e d in that the building element (1, 15-18) constitutes primary beams in the

building frame, and in that the secondary beam of the building frame extends between the primary beams constituted by the building elements in the same plane as the latter and is supported by its ends in the supporting elements (5), in conjunction with which upwardly extending uprights (20) are supported in certain of the supporting elements, which uprights support a building structure such as an external roof above the plane of the primary and secondary beams.

6. The application in a building frame in accordance with Patent Claim 5, c h a r a c t e r i z e d in that the uprights (20) are so adapted with regard to their height that, with a starting point on said plane of the horizontally extending primary and secondary beams, they support at their upper ends the superjacent building structure at a certain angle of pitch.

1/9

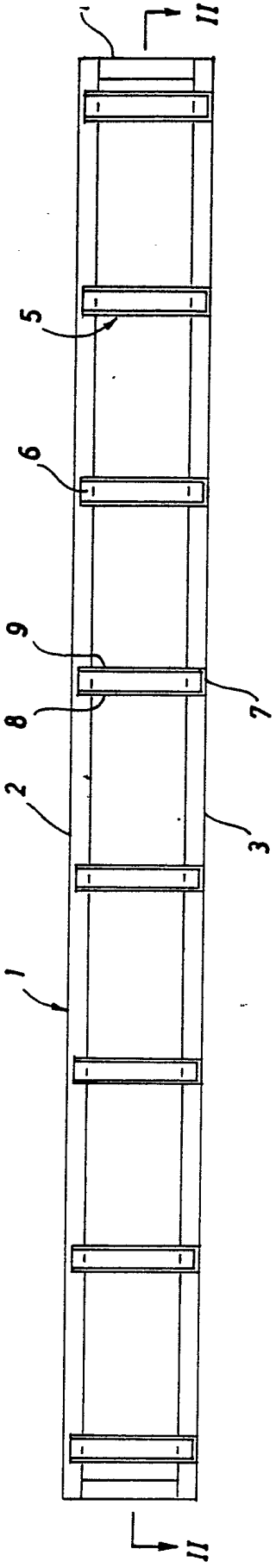


Fig. 1

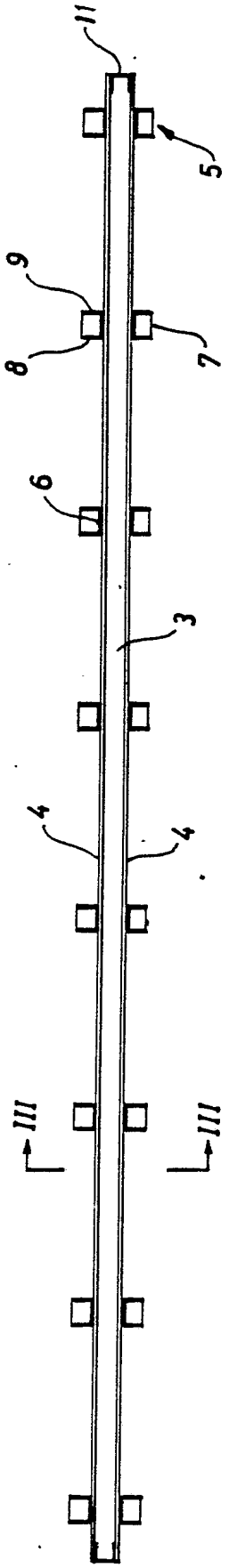
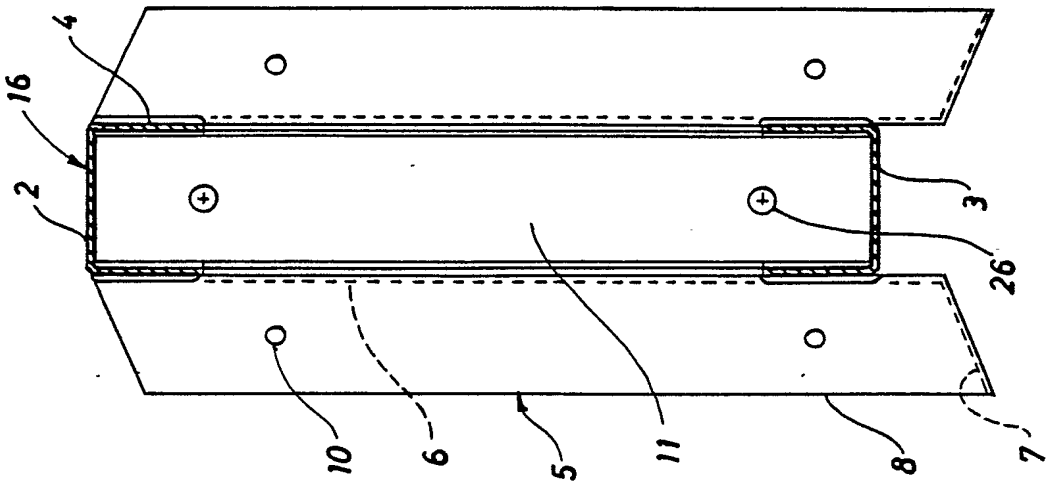


Fig. 2

Fig. 5



2/9

Fig. 4

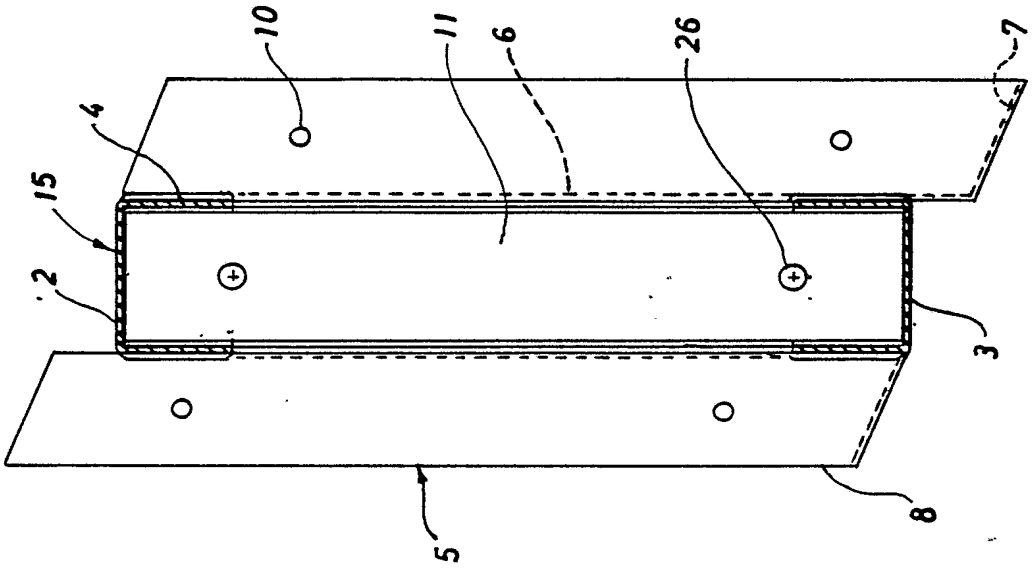


Fig. 3

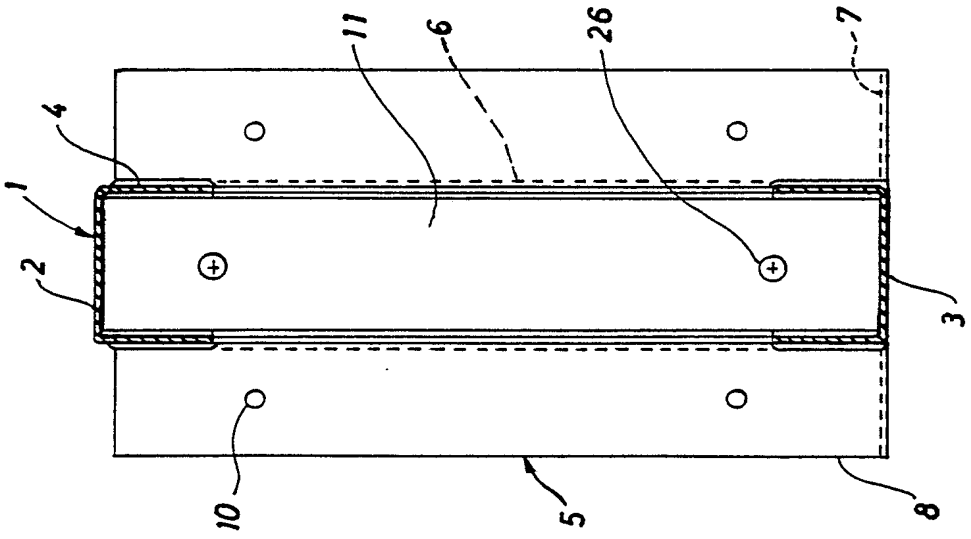
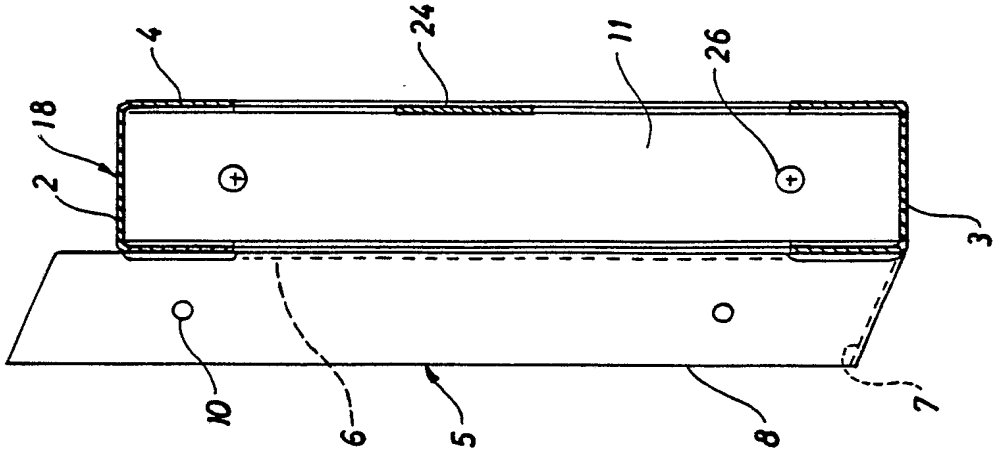
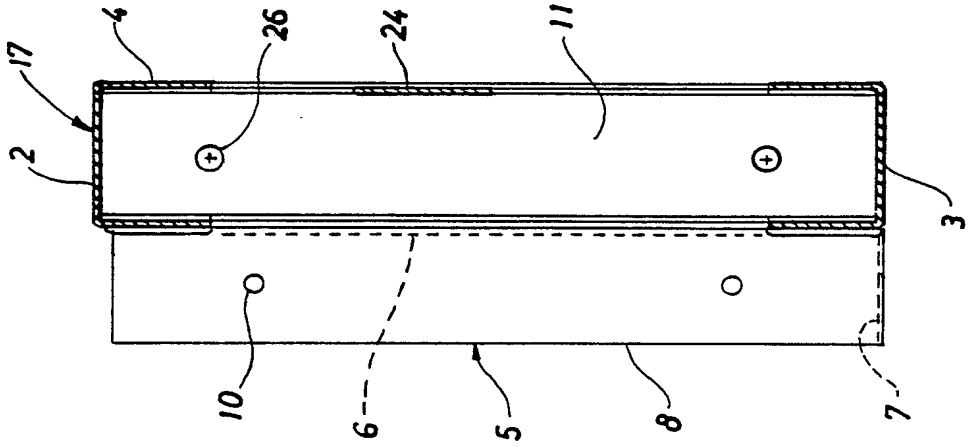


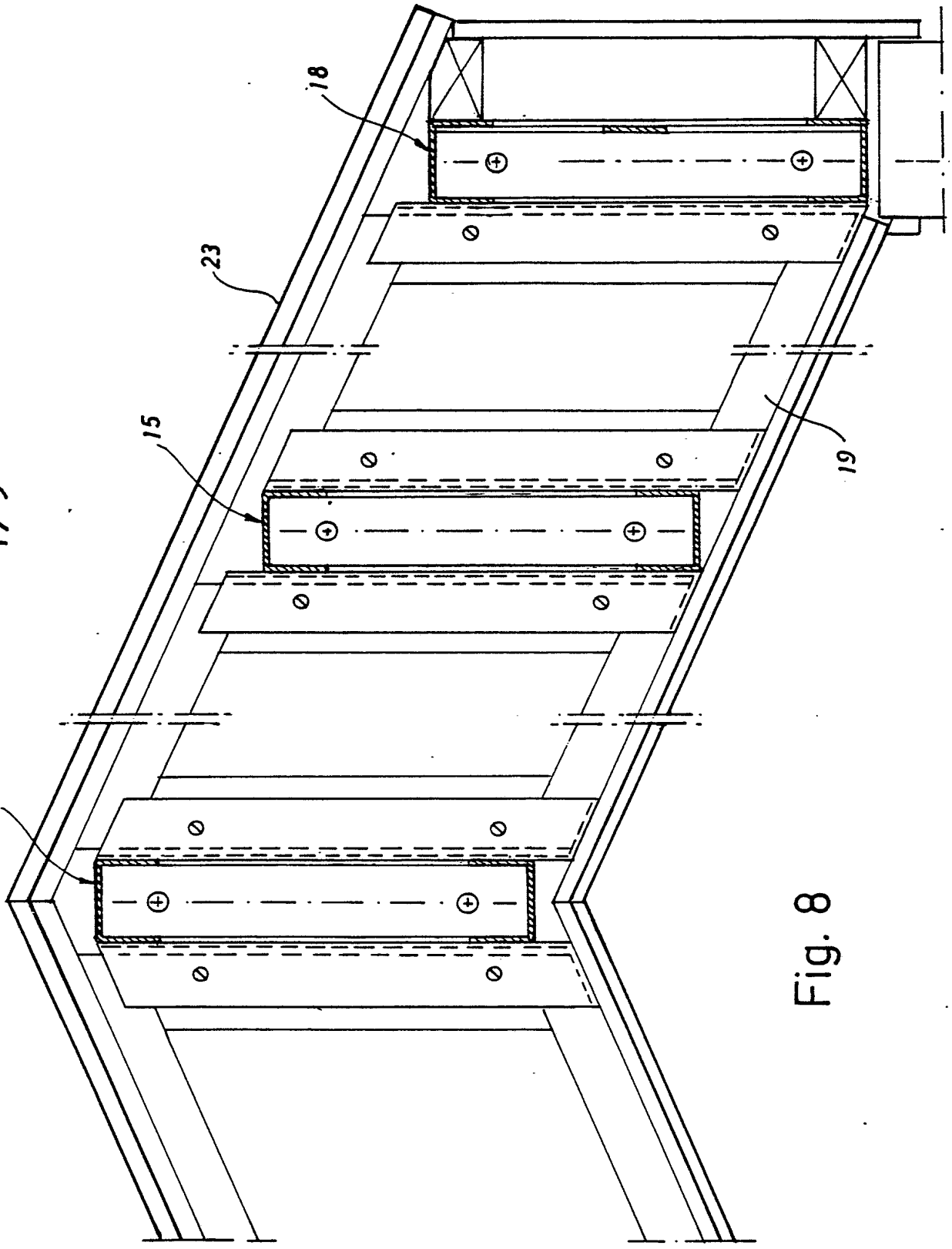
Fig. 7



3/9

Fig. 6





4/9

Fig. 8

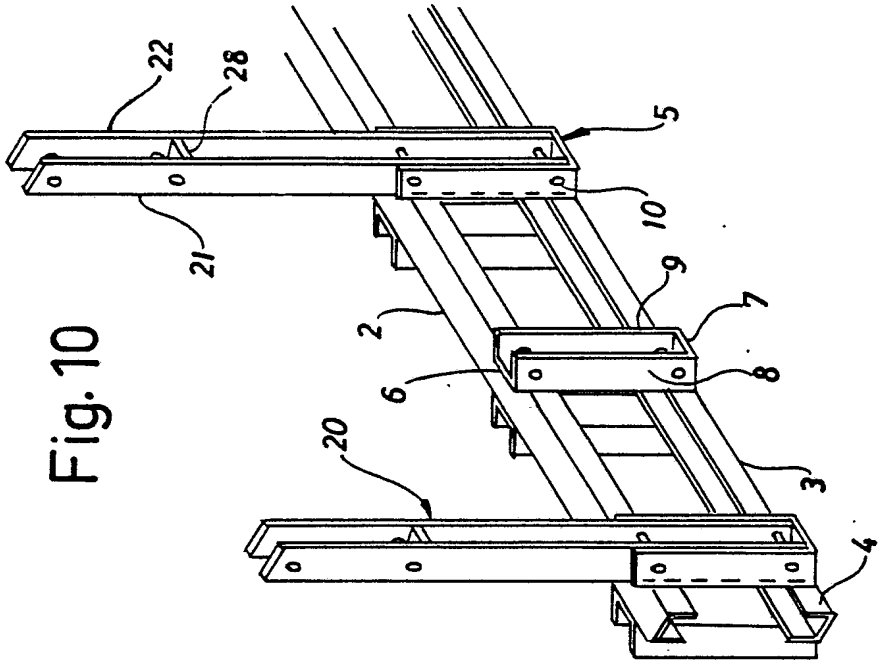


Fig. 10

Fig. 9

5/9

6/9

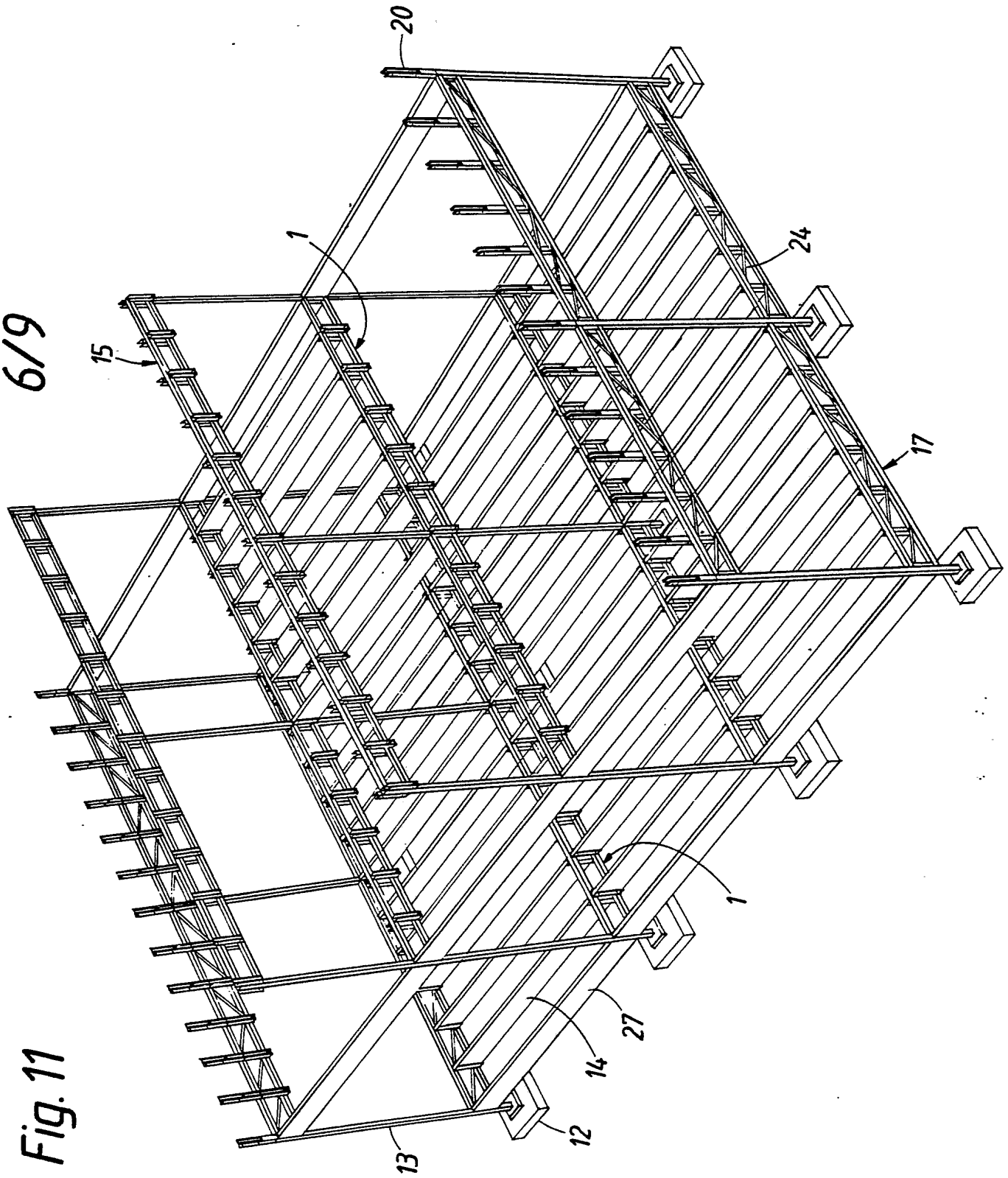


Fig. 11

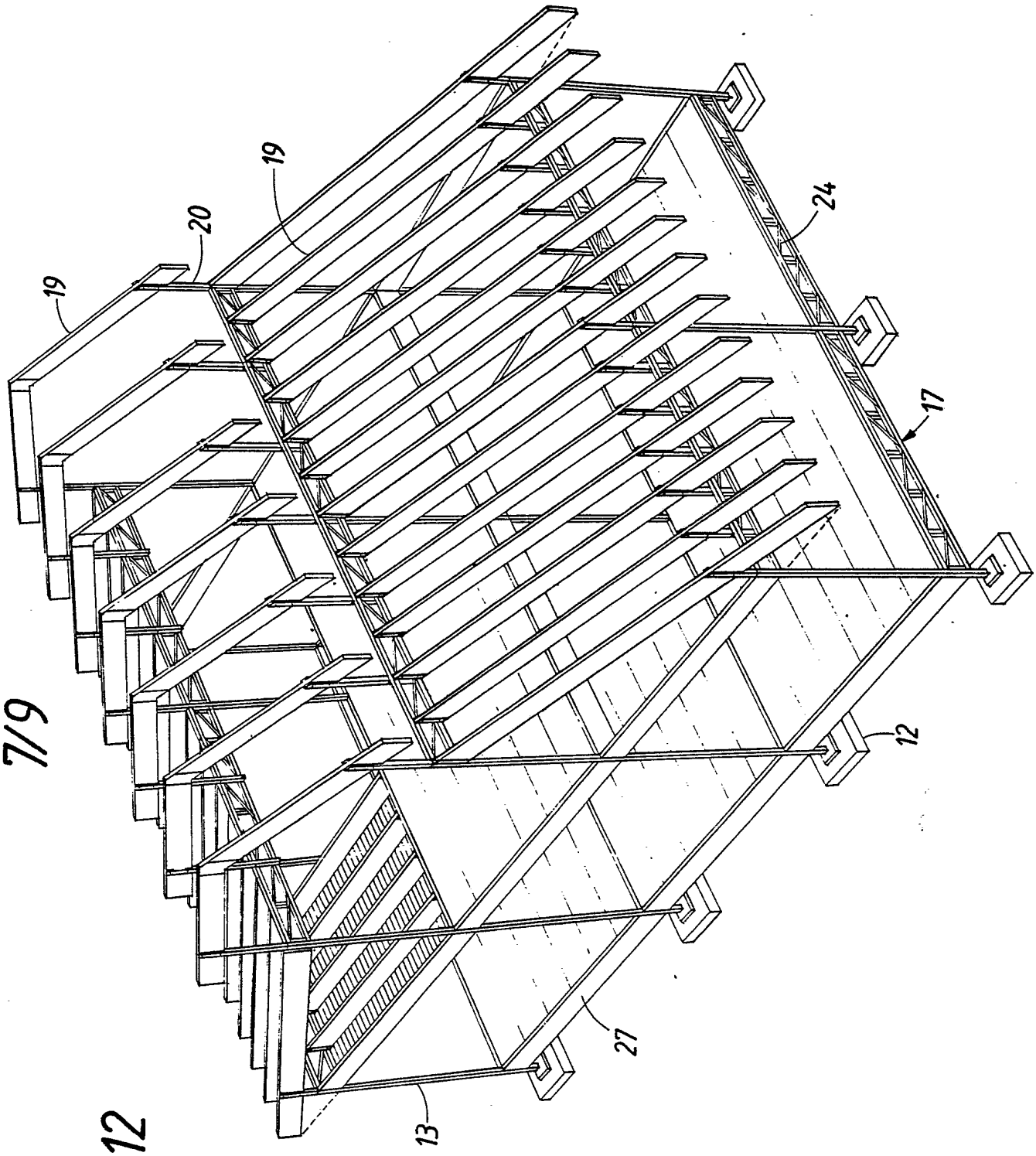


Fig. 12

7/9

8/9

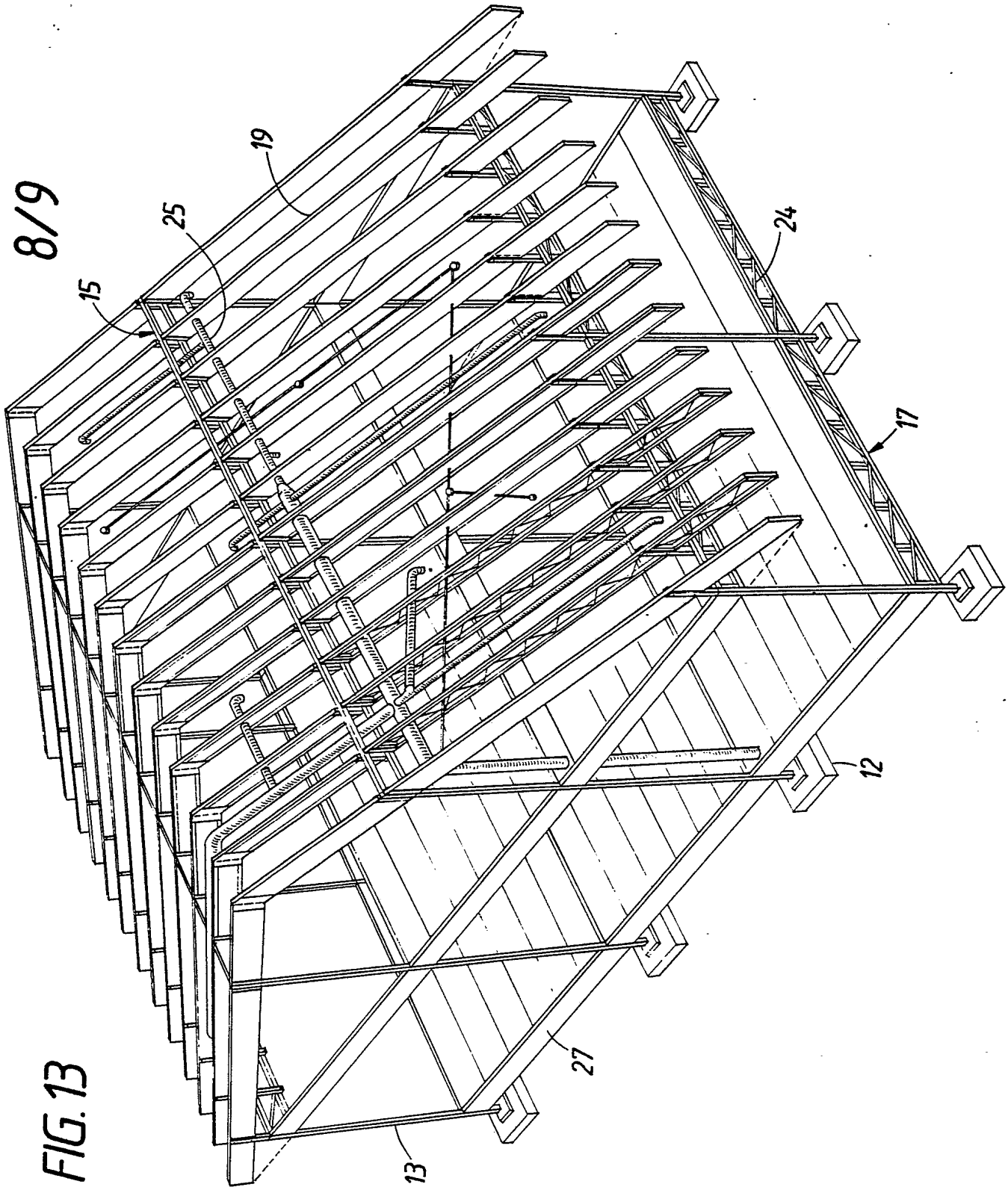


FIG. 13

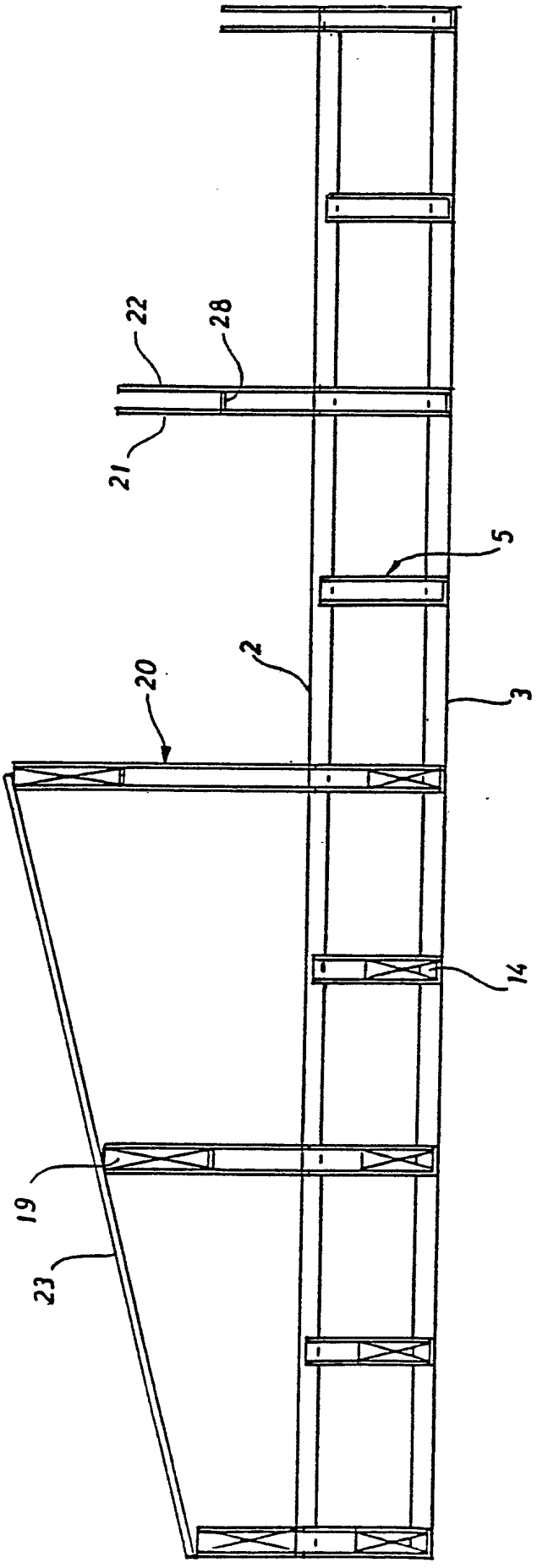


Fig. 14

9/9

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE86/00302

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

E 04 C 3/08 // E 04 B 1/24

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC 4	E 04 B 1/08,./18, /19, /24, /30; E 04 C 3/02, /04, /08, /09
US Cl	52: 280-283, 637-645, 656-658, 690-695, 730-732

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched [8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	SE, B, 426 084 (CSONGRAD MEGYEI TANASCI EPITÖIPARI VALLALAT) 6 December 1982	
A	CH, A, 512 643 (HOCH A) 29 October 1971	
A	US, A, 2 152 189 (HENDERSON A) 28 March 1939	

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
1986-08-22	1986 -09- 10
International Searching Authority	**Signature of Authorized Officer**
Swedish Patent Office	Ingemar Hedlund

Form PCT/ISA/210 (second sheet) (January 1985)